PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 32026WOP00	FOR FURTHER ACTION	See Form PCT/IPEA/416
International application No. PCT/AU2004/000947	International filing date *(day/month/year)* 14 July 2004	Priority date *(day/month/year)* 14 July 2003
International Patent Classification (IPC) or national classification and IPC Int. Cl.[7] G02B 5/28, H04J 14/02		
Applicant COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION et al		

This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

3. This report is also accompanied by ANNEXES, comprising:

a. [X] *(sent to the applicant and to the International Bureau)* a total of 16 sheets, as follows:

- [X] sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
- [ ] sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

b. [ ] *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or table related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

- [X] Box No. I Basis of the report
- [ ] Box No. II Priority
- [ ] Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- [ ] Box No. IV Lack of unity of invention
- [X] Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- [ ] Box No. VI Certain documents cited
- [ ] Box No. VII Certain defects in the international application
- [X] Box No. VIII Certain observations on the international application

Date of submission of the demand 16 May 2005	Date of completion of the report 13 September 2005
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer IRINA TALANINA Telephone No. (02) 6283 2203

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International application No.
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Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This report is based on translations from the original language into the following language which is the language of a translation furnished for the purposes of:

☐ international search (under Rules 12.3 and 23.1 (b))

☐ publication of the international application (under Rule 12.4)

☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the elements of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

☐ the international application as originally filed/furnished

☒ the description:

pages **1-3, 7-15, 17, 18** as originally filed/furnished

pages* **4-6, 16, 16a, 19, 20** received by this Authority on **19 August 2005** with the letter of **19 August 2005**

pages* received by this Authority on with the letter of

☒ the claims:

pages as originally filed/furnished

pages* as amended (together with any statement) under Article 19

pages* **21-29** received by this Authority on **19 August 2005** with the letter of **19 August 2005**

pages* received by this Authority on with the letter of

☒ the drawings:

pages **1/19 – 19/19** as originally filed/furnished

pages* received by this Authority on with the letter of

pages* received by this Authority on with the letter of

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages

☐ the claims, Nos.

☐ the drawings, sheets/figs

☐ the sequence listing (*specify*):

☐ any table(s) related to the sequence listing (*specify*):

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

☐ the description, pages

☐ the claims, Nos.

☐ the drawings, sheets/figs

☐ the sequence listing (*specify*):

☐ any table(s) related to the sequence listing (*specify*):

* *If item 4 applies, some or all of those sheets may be marked "superseded."*

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
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Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement .

1. Statement

Novelty (N)	Claims	1-52	YES
	Claims	-	NO
Inventive step (IS)	Claims	1-52	YES
	Claims	-	NO
Industrial applicability (IA)	Claims	1-52	YES
	Claims	-	NO

2. Citations and explanations (Rule 70.7)

Claims 1-52 meet the criteria set out in PCT Article 33(2)-(4) because the prior art does not teach or fairly suggest an optical filter having a passband of less than 1 nm and including a plurality of cavities with at least one spacer of thickness greater than 7 microns, the spacer defining two opposed surfaces each having a plurality of thin layers disposed thereon, wherein the total number of thin layers per cavity is less than 35 and wherein the maximum allowable uniformity error in the thickness of each thin layer is within the range of 1 part in 50,000 to 3 parts in 1000. The prior art documents listed in the International Search Report disclose the optical filters having the passbands much larger than 1 nm and more relaxed tolerances on the uniformity of each thin layer thickness.

The invention has industrial applicability in optical filter devices.

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

(i) Claim 43 is not clear because I cannot find an antecedent to "said channels" when claim 43 is appended to any one of claims 34 to 42.

DISCLOSURE OF THE INVENTION:

According to a first aspect of the invention there is provided an optical filter having a passband of less than 1nm, said filter including a plurality of cavities, one or more of said cavities including a spacer of thickness greater than 7 μm, said spacer defining two opposed surfaces each having a plurality of thin layers disposed thereon, wherein the total number of thin layers per cavity is less than 35 and wherein the maximum allowable uniformity error in the thickness of each of said thin layers is within the range of 1 part in 50,000 to 3 parts in 1000.

In some embodiments the average number of thin layers per cavity is substantially less than 35 and the thickness of each of the spacers is substantially greater than 7μm.

According to a second aspect, the present invention provides an optical interleaver having a passband of less than 1nm, the interlever including a plurality of cavities, one or more of said cavities including a spacer of thickness greater than 7 μm, said spacer defining two opposed surfaces each having a plurality of thin layers disposed thereon, wherein the average number of thin layers per cavity is less than 35 and wherein the maximum allowable uniformity error in the thickness of each of the thin layers is within the range of 1 part in 50,000 to 3 parts in 1000.

According to a third aspect, the present invention provides an optical interleaver adapted to receive a dense wavelength division multiplexed optical input signal including a plurality of channels ranging in frequency between approximately 1520nm and 1570nm, said interleaver being adapted to split said input into an output of at least two sub-sets of channels, wherein each channel has a bandwidth of less than 1nm, said interleaver having a plurality of cavities, one or more of said cavities including a spacer of thickness greater than 7 μm and wherein said spacer defines two opposed surfaces each having a plurality of thin layers disposed thereon, wherein the average number of thin layers per cavity is less

than 35 and wherein the maximum allowable uniformity error in the thickness of each of said thin layers is within the range of 1 part in 50,000 to 3 parts in 1000.

According to a fourth aspect, the present invention provides a method of manufacturing an optical filter as described above, said method including the steps of:

producing a plurality of spacers by optically polishing a substrate, wherein at least one of said spacers has a thickness of greater than 7μm;

using thin film deposition to deposit a plurality of thin layers onto each of said spacers to form cavities, whereby the average number of thin layers per cavity is less than 35 and wherein the maximum allowable uniformity error in the thickness of each of said thin layers is within the range of 1 part in 50,000 to 3 parts in 1000; and

optically contacting said plurality of cavities to form said filter.

According to a fifth aspect, the present invention provides a method of manufacturing an optical filter as described above, said method including the steps of:

a) utilising thick film deposition to produce a spacer having a thickness of greater than 7μm;

b) utilising thin film deposition to deposit a plurality of thin layers onto said spacer to form a cavity, the average number of thin layers per cavity being less than 35 and wherein the maximum allowable uniformity error in the thickness of each of said thin layers is within the range of 1 part in 50,000 to 3 parts in 1000; and

c) repeating combinations of steps a) and b) so as to form said filter.

According to a sixth aspect, the present invention provides a method of manufacturing an optical interleaver as described above, said method including the steps of:

producing a plurality of spacers by optically polishing a substrate, wherein at least one of said spacers has a thickness of greater than 7μm;

using thin film deposition to deposit a plurality of thin layers onto each of said spacers to form cavities, whereby the average number of thin layers per cavity is less than 35 and wherein the maximum allowable uniformity error in the thickness of each of said thin layers is within the range of 1 part in 50,000 to 3 parts in 1000; and

optically contacting said plurality of cavities to form said interleaver.

According to another aspect, the present invention provides a method of manufacturing an optical interleaver as described above, said method including the steps of:

a) utilising thick film deposition to produce a spacer having a thickness of greater than 7μm;

b) utilising thin film deposition to deposit a plurality of thin layers onto said spacer to form a cavity, the average number of thin layers per cavity being less than 35 and wherein the maximum allowable uniformity error in the thickness of each of said thin layers is within the range of 1 part in 50,000 to 3 parts in 1000; and

c) repeating combinations of steps a) and b) so as to form said interleaver.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a schematic diagram depicting a typical narrow band filter according to the prior art;

Figures 2 to 7 are graphs illustrating various performance characteristics of a typical example of the prior art filter according to figure 1, as described in more detail in the above discussion of the prior art;

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fibres to be dramatically increased, thereby helping to address the rapidly growing world wide demand for digital telecommunications, for example due to increases in internet usage.

Preferred Methods for Manufacturing Filters According to the Invention:

A first preferred method of manufacturing an optical filter 1 in accordance with the invention includes the steps of:

producing a plurality of spacers 5 by optically polishing a substrate, wherein at least one of said spacers 5 has a thickness of greater than 7μm;

using thin film deposition to deposit a plurality of thin layers 7 onto each of said spacers 5 to form cavities 4, whereby the average number of thin layers 7 per cavity 4 is less than 35 and wherein the maximum allowable uniformity error in the thickness of each of said thin layers is within the range of 1 part in 50,000 to 3 parts in 1000; and

optically contacting said plurality of cavities 4 to form said filter 1.

It will be appreciated that the spacer thicknesses tolerances required for manufacture of the preferred embodiments of the optical filter are within the capabilities of those skilled in the art of optical polishing. Similarly, the required thin layer tolerances are within the capabilities of those skilled in the art of thin film deposition.

The second preferred method of manufacturing an optical filter 1 in accordance with the invention includes the steps of:

a) utilising thick film deposition to produce a spacer 5 having a thickness of greater than 7μm;

b) utilising thin film deposition to deposit a plurality of thin layers 7 onto said spacer 5 to form a cavity 4, the average number of thin layers 7 per cavity 4 being

less than 35 and wherein the maximum allowable uniformity error in the thickness of each of said thin layers is within the range of 1 part in 50,000 to 3 parts in 1000; and

c) repeating combinations of steps a) and b) so as to form said filter 1.

In the exemplary preferred embodiments described above the spacer is made of SiO_2, a material with a relatively low refractive index in comparison to many other

8mm, consisting of a total of 41 layers (optimised down from the starting design of 43 layers, 3 S 3 S 3 S...). There are 10 high order thick layers and 31 λ/4 layers.

Figures 28 and 29 show the spectral transmittance and reflectance respectively of the preferred embodiment. It can be seen that the preferred embodiment divides the input signal into alternate odd and even channels.

As was the case for the filter described above, the tolerances for the interleaver are relatively relaxed compared to the prior art. The maximum allowable uniformity error in the thickness of each of said thin layers is preferably equal to or less than 5nm. The maximum allowable uniformity error in the thickness of each of said spacers is equal to or less than 8nm. Figures 30 and 31 show the effects of these errors respectively.

Preferred Methods for Manufacturing Interleavers According to the Invention:

A first preferred method of manufacturing an optical interleaver as described above includes the steps of:

producing a plurality of spacers by optically polishing a substrate, wherein at least one of said spacers has a thickness of greater than 7μm;

using thin film deposition to deposit a plurality of thin layers onto each of said spacers to form cavities, whereby the average number of thin layers per cavity is less than 35 and wherein the maximum allowable uniformity error in the thickness of each of said thin layers is within the range of 1 part in 50,000 to 3 parts in 1000; and

optically contacting said plurality of cavities to form said interleaver.

An alternative preferred method of manufacturing an optical filter as described above includes the steps of:

a) utilising thick film deposition to produce a spacer having a thickness of greater than 7μm;

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b) utilising thin film deposition to deposit a plurality of thin layers onto said spacer to form a cavity, the average number of thin layers per cavity being less than 35 and wherein the maximum allowable uniformity error in the thickness of each of said thin layers is within the range of 1 part in 50,000 to 3 parts in 1000; and

c) repeating combinations of steps a) and b) so as to form said interleaver.

Although the invention has been described with reference to specific examples, it will be appreciated by those skilled in the art that it may be embodied in many other forms.

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THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. [AMENDED] An optical filter having a passband of less than 1nm, said filter including a plurality of cavities, one or more of said cavities including a spacer of thickness greater than 7 μm, said spacer defining two opposed surfaces each having a plurality of thin layers disposed thereon, wherein the total number of thin layers per cavity is less than 35 and wherein the maximum allowable uniformity error in the thickness of each of said thin layers is within the range of 1 part in 50,000 to 3 parts in 1000.

2. [RENUMBERED] [PREVIOUS CLAIM 2 DELETED] An optical filter according to claim 1 wherein the thickness of the spacer is greater than 10 μm.

3. [RENUMBERED] An optical filter according to any one of the preceding claims wherein the thickness of the spacer is greater than 20 μm.

4. [RENUMBERED] An optical filter according to any one of the preceding claims wherein the thickness of the spacer is greater than 50 μm.

5. [RENUMBERED] An optical filter according to any one of the preceding claims wherein the thickness of the spacer is greater than 100 μm.

6. [RENUMBERED] An optical filter according to any one of the preceding claims wherein the average number of thin layers per cavity is less than 30.

7. [RENUMBERED] An optical filter according to any one of the preceding claims wherein the average number of thin layers per cavity is less than 25.

8. [RENUMBERED] An optical filter according to any one of the preceding claims wherein the average number of thin layers per cavity is less than 15.

9. [RENUMBERED] [PREVIOUS CLAIM 10 AND 11 DELETED} An optical filter according to any one of the preceding claims wherein said filter has a passband of less than 0.5nm.

10. [RENUMBERED] An optical filter according to any one of the preceding claims wherein said filter is adapted to receive a dense wavelength division multiplexed

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optical signal including a plurality of channels within a predetermined frequency range.

11. [RENUMBERED] An optical filter according to claim 10 wherein said predetermined frequency range is approximately 1520nm to 1570nm.

12. [RENUMBERED] An optical filter according to any one of the preceding claims wherein at least one of the cavities is formed in accordance with the following formula:

(HL)^6 HMH (LH)^6

where H is a quarter wavelength layer of material having a refractive index of approximately 2.065, L is a quarter wavelength layer of material having a refractive index of approximately 1.465 and M is a spacer of approximately 21μm thickness and having an approximate refractive index of 1.465.

13. [RENUMBERED] An optical filter according to any one of the preceding claims wherein said optical filter is in accordance with the following formula:

((HL)^6 HMH (LH)^6 L)^3

where H is a quarter wavelength layer of material having a refractive index of approximately 2.065, L is a quarter wavelength layer of material having a refractive index of approximately 1.465 and M is a spacer of approximately 21μm thickness and having an approximate refractive index of 1.465.

14. [RENUMBERED] An optical filter according to claim 12 or 13 wherein the maximum allowable uniformity error in the thickness of each of said thin layers is within the range of 1 part in 50,000 to 4 parts in 10,000.

15. [RENUMBERED] An optical filter according to any one of the preceding claims wherein the maximum allowable absorption in each of said thin layers corresponds to an extinction coefficient of between 1×10^{-4} and 1×10^{-5}.

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16. [RENUMBERED] An optical filter according to any one of the preceding claims wherein the maximum allowable uniformity error in the thickness of each of said spacers is less than or equal to 0.53nm.

17. [RENUMBERED] An optical filter according to any one of claims 1 to 11 wherein at least one of the cavities is formed in accordance with the following formula:

(HL)^4 HMH (LH)^4

where H is a quarter wavelength layer of material having a refractive index of approximately 2.065, L is a quarter wavelength layer of material having a refractive index of approximately 1.465 and M is a spacer of approximately 106μm thickness and having an approximate refractive index of 1.465.

18. [RENUMBERED] An optical filter according to any one of claims 1 to 11 wherein said optical filter is in accordance with the following formula:

((HL)^4 HMH (LH)^4 L)^3

where H is a quarter wavelength layer of material having a refractive index of approximately 2.065, L is a quarter wavelength layer of material having a refractive index of approximately 1.465 and M is a spacer of approximately 106μm thickness and having an approximate refractive index of 1.465.

19. [RENUMBERED] An optical filter according to claim 17 or 18 wherein said optical filter is used in combination with a blocking filter having a passband of approximately 12nm so as to block adjacent side orders.

20. [RENUMBERED] An optical filter according to any one of claims 17 to 19 wherein the maximum allowable uniformity error in the thickness of each of said thin layers is within the range of 1 part in 50,000 to 3 parts in 2,000.

21. [RENUMBERED] An optical filter according to any one of claims 1 to 11 wherein at least one of the cavities is formed in accordance with the following formula:

(HL)^4 HMH (LH)^4

where H is a quarter wavelength layer of material having a refractive index of approximately 2.065, L is a quarter wavelength layer of material having a refractive index of approximately 1.465 and M is a spacer of approximately 529μm thickness and having an approximate refractive index of 1.465.

22. [RENUMBERED] An optical filter according to any one of claims 1 to 11 wherein said optical filter is in accordance with the following formula:

((HL)^4 HMH (LH)^4 L)^3

where H is a quarter wavelength layer of material having a refractive index of approximately 2.065, L is a quarter wavelength layer of material having a refractive index of approximately 1.465 and M is a spacer of approximately 529μm thickness and having an approximate refractive index of 1.465.

23. [RENUMBERED] An optical filter according to claim 21 or 22 wherein said optical filter is used in combination with a blocking filter having a passband of approximately 2.4nm so as to block adjacent side orders.

24. [RENUMBERED] An optical filter according to any one of claims 21 to 23 wherein said filter has a passband of less than 0.05nm.

25. [RENUMBERED] An optical filter according to any one of claims 21 to 24 wherein the maximum allowable uniformity error in the thickness of each of said thin layers is within the range of 1 part in 50,000 to 1.2 parts in 1,000.

26. [RENUMBERED] An optical filter according to any one of claims 21 to 25 wherein the maximum allowable uniformity error in the thickness of each of said spacers is less than or equal to 1.6nm.

27. [RENUMBERED] An optical filter according to any one of claims 1 to 11 wherein said optical filter is in accordance with the following formula:

(HL)^2 HMH (LH)^2 L ((HL)^3 HMH (LH)^3 L)^2 (HL)^2 HMH (LH)^2

where H is a quarter wavelength layer of material having a refractive index of approximately 2.065, L is a quarter wavelength layer of material having a refractive

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index of approximately 1.465 and M is a spacer of approximately 1.32mm thickness and having an approximate refractive index of 1.465.

28. [RENUMBERED] An optical filter according to claim 27 wherein said optical filter is used in combination with a blocking filter having a passband of approximately 1nm so as to block adjacent side orders.

29. [RENUMBERED] [PREVIOUS CLAIM 32 DELETED] An optical filter according to any one of claims 27 to 28 wherein the maximum allowable uniformity error in the thickness of each of said spacers is less than or equal to 3.96nm.

30. [RENUMBERED] An optical filter according to any one of claims 1 to 11 wherein said optical filter is in accordance with the following formula:

((HL)^7 HMH (LH)^7 L) ((HL)^8 HMH (LH)^8 L)^2 ((HL)^7 HMH (LH)^7)

where H is a quarter wavelength layer of material having a refractive index of approximately 2.065, L is a quarter wavelength layer of material having a refractive index of approximately 1.465 and M is a spacer of approximately 0.8mm thickness and having an approximate refractive index of 1.465.

31. [RENUMBERED] An optical filter according to claim 30 wherein the maximum allowable uniformity error in the thickness of each of said thin layers is within the range of 1 part in 50,000 to 1 part in 10,000.

32. [RENUMBERED] An optical filter according to any one of claims 30 or 31 wherein the maximum allowable uniformity error in the thickness of each of said spacers is less than or equal to 0.11nm.

33. [RENUMBERED] An optical filter according to any one of claims 30 to 32 wherein said filter has a passband of approximately 0.002nm.

34. [RENUMBERED AND AMENDED] [PREVIOUS CLAIM 38 DELETED] An optical interleaver having a passband of less than 1nm, the interlever including a plurality of cavities, one or more of said cavities including a spacer of thickness greater than 7 μm, said spacer defining two opposed surfaces each having a plurality of thin layers disposed thereon, wherein the average number of thin layers per cavity is less than

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35 and wherein the maximum allowable uniformity error in the thickness of each of the thin layers is within the range of 1 part in 50,000 to 3 parts in 1000.

35. [RENUMBERED] [PREVIOUS CLAIM 40 DELETED] An optical interleaver according to claim 34 wherein the average number of thin layers per cavity is less than 30.

36. [RENUMBERED] An optical interleaver according to claim 34 or 35 wherein the thickness of the spacer is greater than 10 μm.

37. [RENUMBERED] An optical interleaver according to claim 34 or 35 wherein the thickness of the spacer is greater than 20 μm.

38. [RENUMBERED] An optical interleaver according to claim 34 or 35 wherein the thickness of the spacer is greater than 50 μm.

39. [RENUMBERED] An optical interleaver according to claim 34 or 35 wherein the thickness of the spacer is greater than 100 μm.

40. [RENUMBERED] An optical interleaver according to any one of claims 34 to 39 wherein the total number of thin layers per cavity is less than 25.

41. [RENUMBERED] An optical interleaver according to any one of claims 34 to 39 wherein the total number of thin layers per cavity is less than 15.

42. [RENUMBERED] An optical interleaver according to any one of claims 34 to 39 wherein the total number of thin layers per cavity is less than 10.

43. [RENUMBERED] [PREVIOUS CLAIMS 49, 50 AND 51 DELETED] An optical interleaver according to any one of claims 34 to 42 wherein each of said channels has a bandwidth of less than 0.5μm.

44. [RENUMBERED] [PREVIOUS CLAIM 53 DELETED] An optical interleaver according to any one of claims 34 to 43 wherein at least one of the cavities is formed in accordance with the following formula:

HLHM

where H is a quarter wavelength layer of material having a refractive index of approximately 2.065, L is a quarter wavelength layer of material having a refractive index of approximately 1.465 and M is a spacer of approximately 0.8mm thickness and having an approximate refractive index of 1.465.

45. [RENUMBERED] An optical interleaver according to any one of claims 34 to 44 wherein said interleaver is formed in accordance with the following formula:

(HLHM)^10 HLH

where H is a quarter wavelength layer of material having a refractive index of approximately 2.065, L is a quarter wavelength layer of material having a refractive index of approximately 1.465 and M is a spacer of approximately 0.8mm thickness and having an approximate refractive index of 1.465.

46. [RENUMBERED] An optical interleaver according to any one of claims 34 to 45 wherein the maximum allowable uniformity error in the thickness of each of said thin layers is equal to or less than 5nm.

47. [RENUMBERED] An optical interleaver according to any one of claims 34 to 46 wherein the maximum allowable uniformity error in the thickness of each of said spacers is equal to or less than 8nm.

48. [RENUMBERED AND AMENDED] An optical interleaver adapted to receive a dense wavelength division multiplexed optical input signal including a plurality of channels ranging in frequency between approximately 1520nm and 1570nm, said interleaver being adapted to split said input into an output of at least two sub-sets of channels, wherein each channel has a bandwidth of less than 1nm, said interleaver having a plurality of cavities, one or more of said cavities including a spacer of thickness greater than 7 μm and wherein said spacer defines two opposed surfaces each having a plurality of thin layers disposed thereon, wherein the average number of thin layers per cavity is less than 35 and wherein the maximum allowable uniformity error in the thickness of each of said thin layers is within the range of 1 part in 50,000 to 3 parts in 1000.

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49. [RENUMBERED AND AMENDED] A method of manufacturing an optical filter in accordance with any one of claims 1 to 33, said method including the steps of:

producing a plurality of spacers by optically polishing a substrate, wherein at least one of said spacers has a thickness of greater than 7μm;

using thin film deposition to deposit a plurality of thin layers onto each of said spacers to form cavities, whereby the average number of thin layers per cavity is less than 35 and wherein the maximum allowable uniformity error in the thickness of each of said thin layers is within the range of 1 part in 50,000 to 3 parts in 1000; and

optically contacting said plurality of cavities to form said filter.

50. [RENUMBERED AND AMENDED] A method of manufacturing an optical filter in accordance with any one of claims 1 to 33, said method including the steps of:

a) utilising thick film deposition to produce a spacer having a thickness of greater than 7μm;

b) utilising thin film deposition to deposit a plurality of thin layers onto said spacer to form a cavity, the average number of thin layers per cavity being less than 35 and wherein the maximum allowable uniformity error in the thickness of each of said thin layers is within the range of 1 part in 50,000 to 3 parts in 1000; and

c) repeating combinations of steps a) and b) so as to form said filter.

51. [RENUMBERED AND AMENDED] A method of manufacturing an optical interleaver in accordance with any one of claims 34 to 48, said method including the steps of:

producing a plurality of spacers by optically polishing a substrate, wherein at least one of said spacers has a thickness of greater than 7μm;

using thin film deposition to deposit a plurality of thin layers onto each of said spacers to form cavities, whereby the average number of thin layers per cavity is less than 35 and wherein the maximum allowable uniformity error in the thickness of each of said thin layers is within the range of 1 part in 50,000 to 3 parts in 1000; and

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optically contacting said plurality of cavities to form said interleaver.

52. [RENUMBERED AND AMENDED] A method of manufacturing an optical interleaver in accordance with any one of claims 34 to 48, said method including the steps of:

a) utilising thick film deposition to produce a spacer having a thickness of greater than 7μm;

b) utilising thin film deposition to deposit a plurality of thin layers onto said spacer to form a cavity, the average number of thin layers per cavity being less than 35 and wherein the maximum allowable uniformity error in the thickness of each of said thin layers is within the range of 1 part in 50,000 to 3 parts in 1000; and

c) repeating combinations of steps a) and b) so as to form said interleaver.